PORTLAND HARBOR PREDREDGE

AND

DISPOSAL STUDY

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INTRODUCTION

The Portland Harbor study proposal specified three data collection efforts: before, during, and after disposal of dredged material (from the Willamette River) at Columbia River mile (CRM) 101. Each effort was to include benthic invertebrate counts, general water quality, finfish abundance, and analysis of fish stomach contents.

A preliminary survey was conducted on 15, 16, and 17 May 1978. Subsequently the overall study was cancelled because the Washington State Department of Ecology would not grant the required permits.

This report outlines data collected during the preliminary survey. Water quality data are minimal because that particular portion of the sampling was to be done 1 or 2 days prior to the disposal operation, which didn't occur.

SAMPLING METHODS

The sampling methods and gear, as well as analytical procedures, for benthos, water quality, and fish abundance were essentially the same as those outlined by Durkin et al. (1979), with the exception of benthic dredge size--the dredge we used was 0.1 m^2.

Samples of demersal fish were taken with a 8-m semi-balloon shrimp trawl 12.6 m overall containing 3.7 cm stretched mesh in the body and a 9.5 mm mesh knotless cod end liner. Each trawl door weighed 10.5 kg. The predredge trawl tows were normally in an upstream (easterly) direction after first releasing 122 m of cable; however, 6 of the 24 tows were made in a downstream or westerly direction. Downstream tows sampled a greater area and were useful for evaluating the effectiveness of upstream catches. All tows were 5 minutes in duration.

Pelagic fish were captured with a purse seine, 151 m long and 6.5 m deep. The net body contained 19 mm stretched mesh, and its bunt had 9.5 mm mesh knotless webbing. Sets were made in an upstream (easterly) direction and fished

for 5 minutes. The predredge purse seine survey consisted of six sets made in the Columbia River and two sets in the Willamette River (Figure 1).

Demersal and pelagic fish were anesthetized, measured, weighed, and a subsample sacrificed for stomach analysis. Marked fish were also retained. After the unmarked fish recovered from the anesthetic they were released at shore associated sites where they would not be taken in subsequent sampling.

The sampling design involved three parallel drag tows above the proposed sediment disposal site, three within it, and three immediately downstream. To test net efficiency, a fourth tow was made in the opposite direction down the center of the river at each area (Figure 1). Purse seining to determine pelagic fish composition consisted of a single series of two sets above, two sets within, and two sets directly below the proposed sediment disposal site (Figure 1).

Replicate "grabs" at twenty benthic stations (40 samples) were taken during the preliminary survey; six each in the upper and lower sites and eight in the disposal area (Figure 2).

SAMPLING RESULTS

Approximately 10 forms of benthic organisms were captured; Table 1 lists these in descending order of abundance. The benthic composition at the study site (CRM 100 to 102) was essentially the same as that reported for CRM 72 (Blahm et al. 1978) and CRM 28 (Durkin et al. 1979). The four or five dominant groups of organisms, Insecta, Bivalvia, Amphipoda, and Oligochaeta, are the same for the three locations. The bottom material at these locations is predominately clean sand which seems to be indicative of ship channel (or near) habitat. Generally benthic biomass found in the channel is less than that found in off channel habitat which may be less dynamic and consist of more stable bottom material (Snyder et al. 1973); (Higley and Holton 1974).

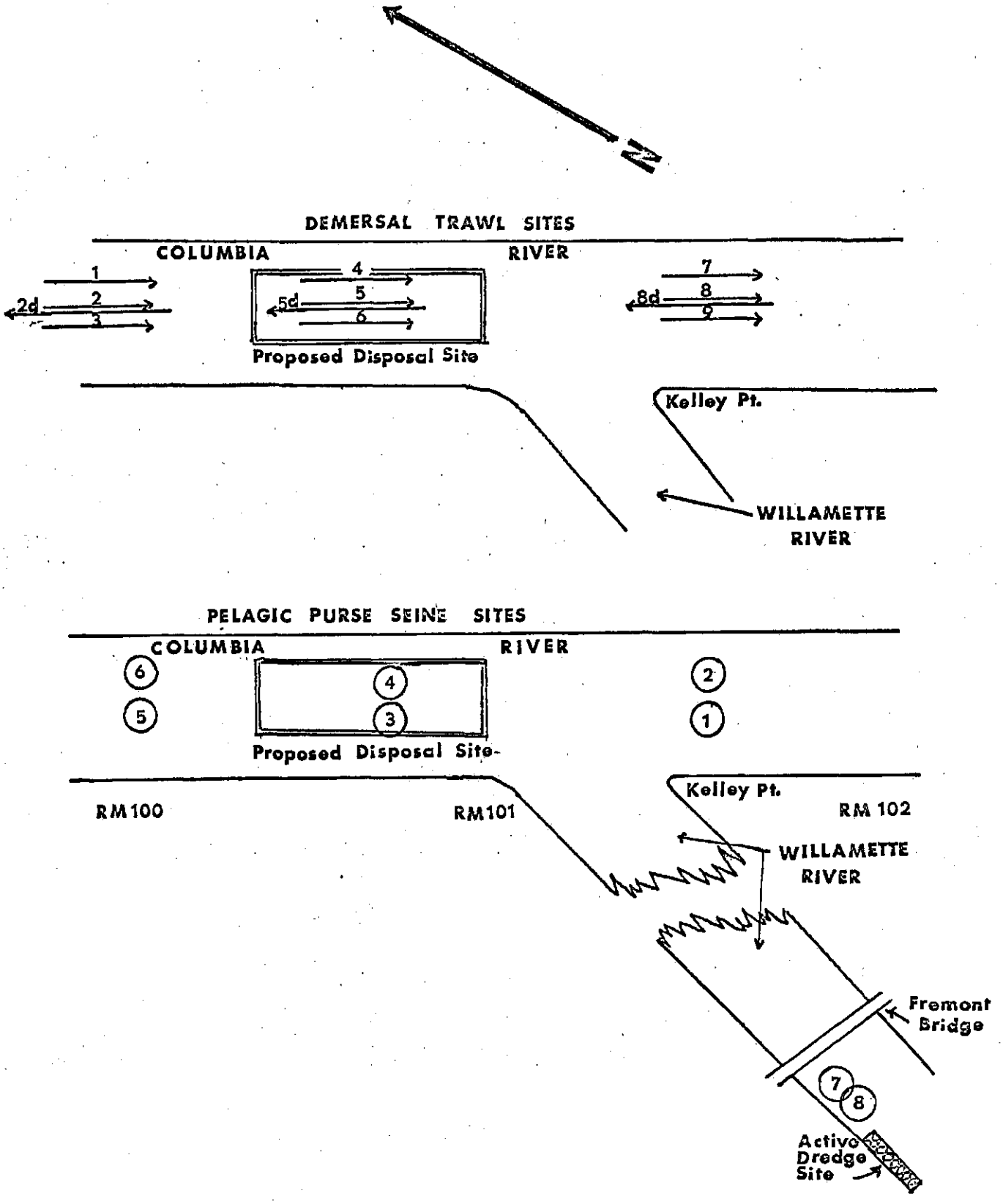
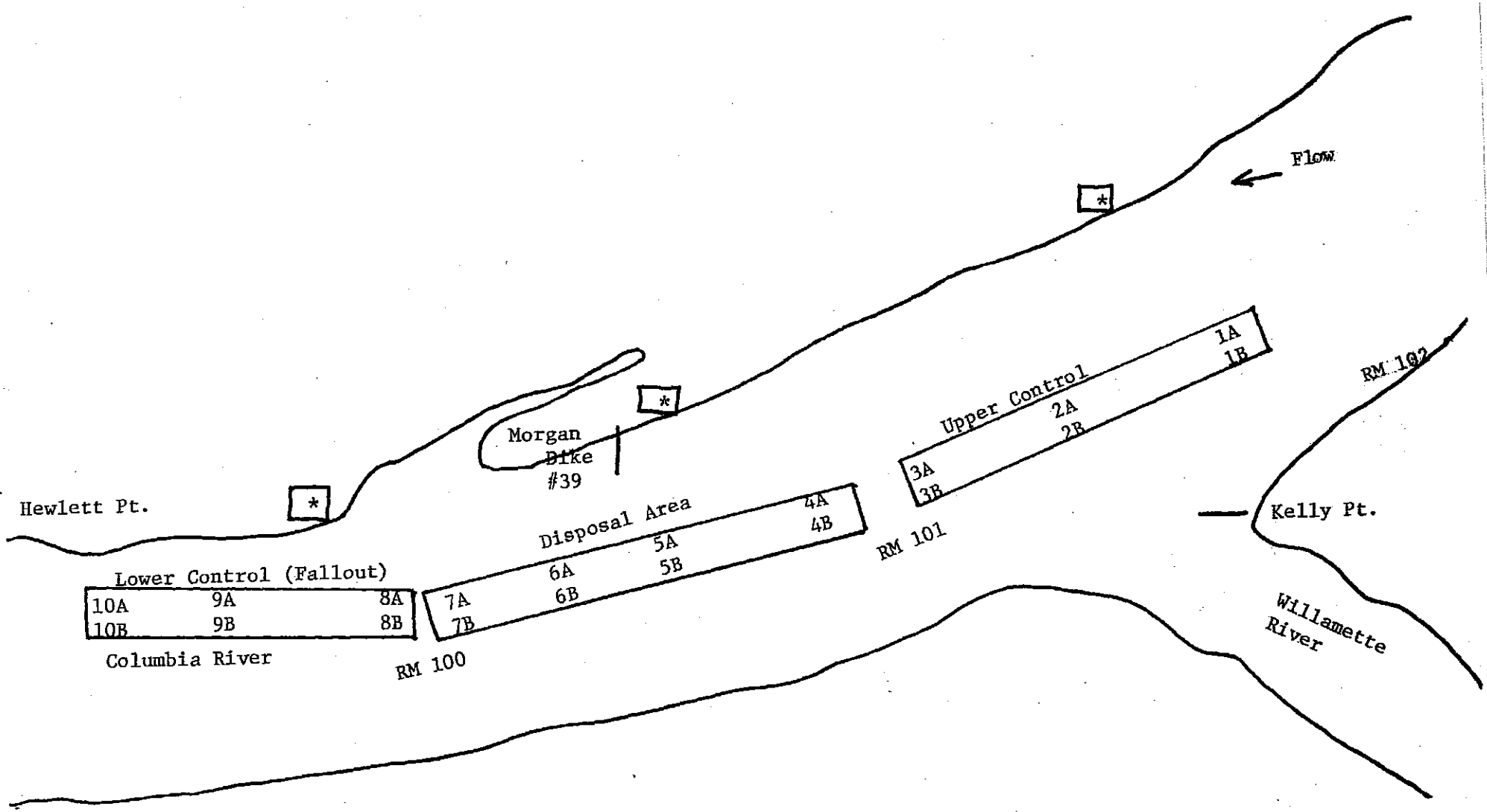


FIGURE 1.--A diagram of demersal and pelagic fish sampling sites in the Columbia and Willamette Rivers in relation to a proposed flow lane dredge disposal site.



* Beach Seine Sites

1/ Sampling Station

Figure 2...Location of the test disposal and control sites at the confluence of the Columbia and Willamette Rivers. Beach seining sites are indicated as well as the sampling stations within the control and planned disposal areas are shown.

Table 1...Benthic organisms captured at the Portland Harbor study site; (15 May 1978) listed in descending order of abundance.

Benthic organisms	Average Number per m^2
Bivalvia	164.90
Diptera	72.23
Amphipoda	32.30
Copepoda	23.23
Oligochaeta	16.27
Cladocera	15.27
Nematoda	1.37
Gastropoda	1.07
Fish Eggs	0.47
Arachnida	0.27
Others	0.20

Benthos in the upper control, disposal, and lower control areas are compared in Table 2. There is variation among organisms and areas; for example, the total catches indicate the lower control is the least productive having approximately one-half the number of organisms per square meter as the upper control.

The position of the lower control area in relation to the mouth of the Willamette River could cause the environment in this location to be more unstable than either the disposal or upper control site. For example, there could be a greater water temperature variation or greater deposition of material carried naturally by the Willamette River--both tend to alter benthic characteristics.

WATER QUALITY

Gross water quality was measured at Station 3B (Figure 2) on 17 May 1978. The results were:

Depth (ft)	Temp. (°C)	Cond. (milimnos/cm)	Turbidity (JTU)	pH	D.O. (mg/liter)	Nonfilterable residue (mg/liter)
0	12.3	0.13	12.1	7.90	11.2	21.6
20	12.3	0.13	12.1	7.95	11.2	21.6
30	12.3	0.13	12.3	7.95	11.2	21.8

There are no outstanding variations in these data as compared to samples taken at Prescott; 1/ consequently, we assume the above results would reflect the normal values for the Columbia River under those conditions which prevailed during the sampling.

Water quality changes rapidly with river flow, weather, and other variables. Because of these rapid changes, a complete water quality survey was not taken during our preliminary effort. We felt it best to wait until immediately prior

1/ National Marine Fisheries Service Field Station at Prescott, Oregon (CRM 72).

Table 2...Number of benthic organisms per square meter within the three sampling areas at the site of the Portland Harbor study (May 1978).

Benthic organisms[1/]	Upper control (12 samples)	Disposal area (16 samples)	Lower control (12 samples)	Average number per m^2
Bivalvia	220.8	155.6	118.3	164.9
Diptera	49.2	103.8	66.7	73.2
Amphipoda	49.2	34.4	13.3	32.3
Copepoda	50.0	14.4	8.3	24.2
Oligochaeta	34.2	3.1	11.5	16.3
Cladocera	17.5	15.0	13.3	15.3
Nematoda	0.8	2.5	0.8	1.4
Gastropoda	---	3.2	---	1.1
Eggs	0.8	0.6	---	0.5
Arachnida	0.8	---	---	0.3
Others	---	0.6	---	0.2
Total	423.3	330.2	232.2	329.7

1/ Includes infauna and epi-benthic organisms.

to the disposal operation (which was ultimately cancelled).

DEMERSAL SAMPLING

The first series of 12 drag tows on 16 May procuded a total of 19 fish (1.6 per set) consisting of several species. Biomass was 3.99 kg with 2.71 kg represented by white sturgeon, *Acipenser transmontanus*. Several salmonids were taken: fall subyearling and spring yearling chinook salmon, *Oncorhynchus tshawytscha*, and a juvenile chum salmon, *O. keta*. There was little difference between the catches at the various sampling areas or between tows made in opposing directions.

The second series of 12 tows on 16-17 May produced 24 fish consisting of eight species and weighing a total of 2.96 kg. A yearling sockeye salmon, *O. nerka*, and a yearling coho salmon, *O. kisutch*, were taken in this series along with a yearling chum and a subyearling fall chinook salmon. White sturgeon again represented the bulk of the biomass (2.78 kg). Trawl catches remained low (2.0 per set) and little change in catches were noted between the various areas or when tows were made in different directions.

PELAGIC SAMPLING

Purse seining in the Columbia River on 5 and 6 June produced 457 fish in six sets. Species taken during seining and drag towing are shown in Table 3. A breakdown, by sampling area, of numbers and weight of fish captured is summarized in Table 3A.

An Index of Relative Importance [IRI=(N+V)F][2/] revealed a balanced fish community in the proposed sediment disposal and comparison areas (Figure 3). Subyearling

2/ Where N represents the numerical percentage, V the gram weight percentage and F the frequency of occurrence percentage. Comparative value of each organism is indicated for each sample. Tests are further described by Pinkas et al. (1971); however, in his tests he used volume percentage rather than gram weight.

Table 3...Finfish found in Portland Harbor predredge pelagic and demersal sampling May and June, 1978; listed in descending order of abundance.

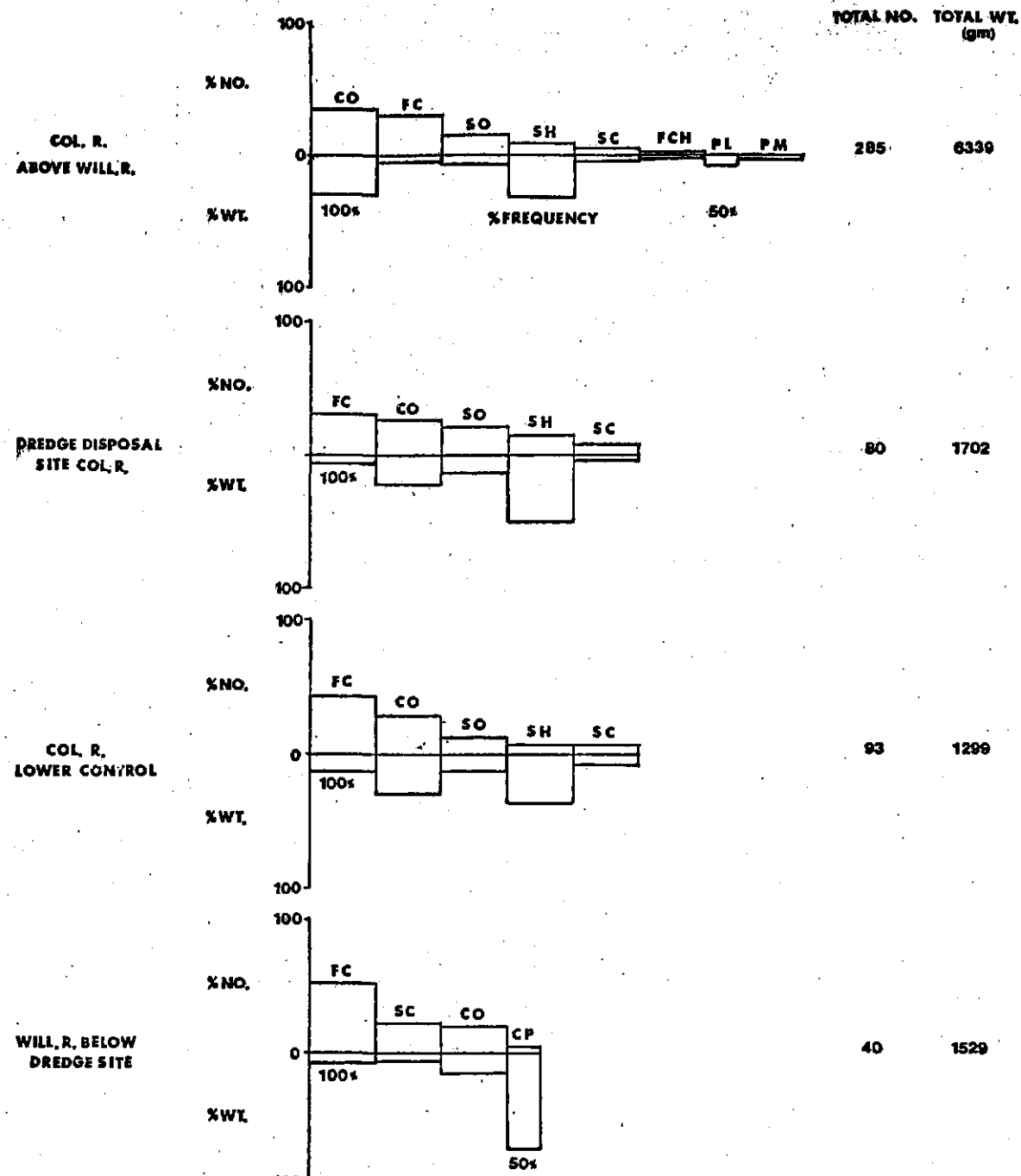
Common name	Scientific name	Trawl tow	Purse seine	Total
Chinook salmon	*Oncorhynchus tshawytscha*	6	216	222
Coho salmon	*Oncorhynchus kisutch*	2	156	158
Sockeye salmon	*Oncorhynchus nerka*	1	73	74
Rainbow trout (steelhead)	*Salmo gairdneri*	0	46	46
Pacific lamprey	*Entosphenus tridentatus*	12	1	13
White sturgeon	*Acipenser transmontanus*	11	0	11
Speckled dace 1/	*Rhinichthys osculus*	5	0	5
Chum salmon	*Oncorhynchus keta*	2	0	2
Carp	*Cyprinus carpio*	0	2	2
Peamouth	*Mylocheilus caurinus*	0	3	3
Coastrange sculpin	*Cottus aleuticus*	2	0	2
Bridgelip sucker	*Catostomus columbianus*	1	0	1
Prickly sculpin	*Cottus asper*	1	0	1

1/ Provisional identification

Table 3A...Summary of purse seine catches by species, number and weight (grams) for Portland Harbor Predredge and Disposal Study Columbia River, June 1978.

Purse Seine Sites 1/	1		2		3		4		5		6							
	Catch																	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	Total No.	Total Wt.	% by No.	% by Wt.	$\bar{x}$ No.	$\bar{x}$ Wt.
Pacific lamprey	--	--	1	538	--	--	--	--	--	--	--	--	1	538	0.00	0.06	--	538.0
Coho	71	1219	30	654	12	244	9	144	6	93	20	308	148	2662	0.32	0.29	125.8	18.0
Sockeye	33	432	11	147	13	195	4	45	9	110	3	41	73	970	0.16	0.10	116.2	13.3
Spring chinook	9	170	8	134	3	44	3	37	3	44	4	63	30	492	0.07	0.05	116.9	16.4
Fall chinook	60	276	26	127	16	69	8	41	2	9	39	167	151	689	0.33	0.07	81.9	4.6
Residual fall chinook	2	76	3	111	--	--	--	--	--	--	--	--	5	187	0.01	0.02	178.2	37.4
Steelhead	26	1948	1	187	10	788	2	203	5	261	46	3482	46	3482	0.10	0.37	203.8	75.7
Peamouth	1	104	2	169	--	--	--	--	--	--	--	--	3	273	0.01	0.03	217.0	91.0
Total	202	4225	82	2067	54	1340	26	362	22	459	71	840	457	9293	100%	99%		

1/ See Figure 1



IRI INDEX	Fall Chinook (FC)	Coho (CO)	Steelhead (SH)	Sockeye (SO)	Sp. Chinook (SC)	Fall Ch. Holdover (FCH)	Pac. Lamprey (PL)	Peamouth (PM)	Carp (CP)	Total
COL. R. ABOVE WILL. R.	3653	6499	4351	2446	1076	556	442	536	0	19559
DREDGE DISPOSAL SITE COL. R.	3646	4905	6688	3535	1226	0	0	0	0	20000
COL. R. LOWER CONTROL	5764	5883	4325	2453	1576	0	0	0	0	20001
WILL. R. BELOW DREDGE SITE	5976	3517	0	0	2845	0	0	0	3831	16169

Figure 3...The index of relative importance (IRI) for purse seine caught finfish at a proposed dredge disposal site in the Columbia River and at a clamshell dredge site in the Willamette River.

fall chinook salmon averaging 81.9 mm, and yearling spring chinook salmon averaging 81.9 mm in length and coho salmon averaging 125.8 mm in length were most frequently captured. Sockeye salmon averaged 116.2 mm, steelhead, *Salmo gairdneri*, averaged 203.8 mm, and yearling spring chinook salmon averaged 116.0 mm, but they all occurred in smaller numbers. Most fish (63%) were captured in the two sets above the confluence of the Willamette River. This suggests a possible association of fish with current flows into the Willamette River and back to the Columbia River via the Multnomah Channel. Extensive purse seine sampling would be needed to verify the possibility that salmonids use this route. Pelagic fish taken in six purse seine sets at the proposed disposal site outnumbered demersal fish taken in 24 demersal tows by a ratio of 10.6 to 1. However, the overall biomass ratio was not as great, with 10.822 kg of pelagic fish and 6.948 kg of demersal fish. The two purse seine sets made in the Willamette River near the Fremont Bridge produced three species of fish totaling 40 individuals. The IRI reveals a somewhat different community structure than found in the Columbia River (Figure 3). Chinook salmon were the most numerous species followed by coho salmon and carp, *Cyprinus carpio*. Coho and fall chinook salmon taken in the Willamette River were larger than those captured in the Columbia River.

MARK RECOVERIES

The eight purse seine sets produced 43 marked juvenile salmon; a recovery rate of 8.7% of all salmonids captured. The recovery rate varied considerably by species, with 18% of the fall chinook salmon, 23% of the spring chinook salmon, 2.6% of the coho salmon, and 10.9% of the steelhead having marks. Seining in the Willamette River produced 38 salmon, of these 20 chinook (that had been reared in South Santiam Hatchery and released in the Willamette River Falls area on 22 and 23 May 1978) were tagged with coded wire tags. The recovery of these fish on 5 June indicated rapid movement. Slower moving spring chinook salmon from

Kooskia Hatchery on Clear Creek, a tributary to the South Fork of the Clearwater River, Idaho, had been released between 6 and 14 April 1979. One spring chinook salmon, two coho salmon, one steelhead, and three fall chinook salmon were transported from McNary Dam, but their release dates were not known. Some fall chinook salmon recaptures were released in April from Wells Dam, Winthrop Hatchery, or Leavenworth Hatchery. Several steelhead were transported from Lower Granite Dam. Recovery data on other marked salmonids are shown in Table 4.

FINFISH FOOD UTILIZATION

The demersal fish catch was small, and 23 (53%) of the 43 fish were examined for stomach contents. Nearly half of the stomachs examined, 11 of the 23, were empty. Of those having food, six had only indistinguishable digested material. The six fish with identifiable contents were white sturgeon (4) and fall chinook salmon (2). Sturgeon consumed the amphipods: *Corophium spinicorne*, and *Anisogammorous* spp., and Diptera (chironomid) larvae. The fall chinook salmon consumed *C. spinicorne* and Diptera.

Pelagic sampling provided substantially greater numbers of fish for stomach analysis than the bottom trawl. Of 254 fish examined, 81% (205) had food in their stomachs. The largest group examined were chinook salmon and they consisted of 34 spring yearlings, 74 fall subyearlings, and 5 fall residual yearlings. There were 92 chinook salmon with food in their stomachs; an incidence of over 89%. Food items in the June sampling were primarily insects and amphipods with some cladocera and copepods. This agrees with the report by Craddock, Blahm, and Parente (1976). Spring chinook salmon preferred Hymenoptera while fall chinook salmon preferred Diptera; however, both stocks consumed a wide variety of organisms (Figure 4). Coho salmon diets are comparable with chinook salmon except in the Willamette River where Lepidoptera were an important biomass item

Table 4...Purse seine mark recoveries Portland Harbor Study, May/June 1978.

Stock	Released	Date	Length(mm)	Recovered	Date	Length(mm)
Chinook-Fall	Willard	25 May	---	CRM 102	5 June	81
Chinook-spring	Round Butte	31 May	118	CRM 102	5 June	126
Chinook-spring	Round Butte	31 May	108	CRM 102	5 June	132
Chinook-spring	Round Butte	22 May	106	CRM 101	5 June	120
Chinook-fall	Wells	April	---	CRM 102	5 June	191
Steelhead	Trans. to Bonneville	April/June	---	CRM 102	5 June	181
Chinook-spring	Trans to McNary	---	---	CRM 100	6 June	121
Chinook-spring	Kooskia/Clear Creek	10-14 April	---	CRM 102	5 June	137
Chinook-fall	Priest Rapids Dam	April	---	CRM 102	5 June	159
Chinook-fall	Icicle Creek	25 April	---	CRM 102	5 June	154
Steelhead	Trans. McNary Dam	---	---	CRM 100	6 June	197
Coho	Hammond	---	---	CRM 101	5 June	118
Steelhead	Winthrop	---	---	CRM 100	6 June	231
Coho	Trans. to McNary Dam	---	---	CRM 100	6 June	145
Chinook-spring	S. Fork Salmon	6-10 April	---	CRM 102	5 June	149
Steelhead	Trans. to Lower Granite Dam	May/June	---	CRM 102	5 June	196
Chinook-spring	Round Butte	22 May	106	CRM 102	5 June	119
Coho	Klickitat River	28 April	---	CRM 100	5 June	161
Steelhead	Ringold	May	---	CRM 102	5 June	248

Table 4...Continued

Stock	Released	Date	Length(mm)	Recovered	Date	Length(mm)
Coho	Trans. to McNary Dam	---	---	CRM 100	6 June	147
Chinook-spring	Round Butte	31 May	118	CRM 100	6 June	130
Chinook-spring	Tag lost	---	---	Willamette River	6 June	106
Chinook-fall	Willamette Falls	1 June	91	Willamette River	6 June	89
Chinook-fall	Willamette Falls	31 May	99	Willamette River	6 June	98
Chinook-fall	Willamette Falls	31 May	99	Willamette River	6 June	90
Chinook-fall	Willamette Falls	31 May	99	Willamette River	6 June	95
Chinook-fall	Willamette Falls	1 June	91	Willamette River	6 June	92
Chinook-fall	Willamette Falls	31 May	101	Willamette River	6 June	109
Chinook-fall	Willamette Falls	31 May	101	Willamette River	6 June	91
Chinook-fall	Willamette Falls	31 May	99	Willamette River	6 June	90
Chinook-fall	Willamette Falls	31 May	99	Willamette River	6 June	95
Chinook-fall	Willamette Falls	1 June	91	Willamette River	6 June	88
Chinook-fall	Willamette Falls	31 May	99	Willamette River	6 June	100
Chinook-fall	Willamette Falls	31 May	101	Willamette River	6 June	96
Chinook-fall	Willamette Falls	1 June	91	Willamette River	6 June	84
Chinook-fall	Willamette Falls	1 June	91	Willamette River	6 June	89

Table 4...Continued

Stock	Released	Date	Length(mm)	Recovered	Date	Length(mm)
Chinook-fall	Willamette Falls	1 June	91	Willamette River	6 June	88
Chinook-fall	Willamette Falls	31 May	99	Willamette River	6 June	99
Chinook-fall	Willamette Falls	1 June	91	Willamette River	6 June	76
Chinook-fall	Willamette Falls	31 May	99	Willamette River	6 June	101
Chinook-fall	Willamette Falls	1 June	91	Willamette River	6 June	91
Chinook-fall	Willamette Falls	1 June	91	Willamette River	6 June	88
Chinook-fall	Willamette Falls	1 June	101	Willamette River	6 June	108

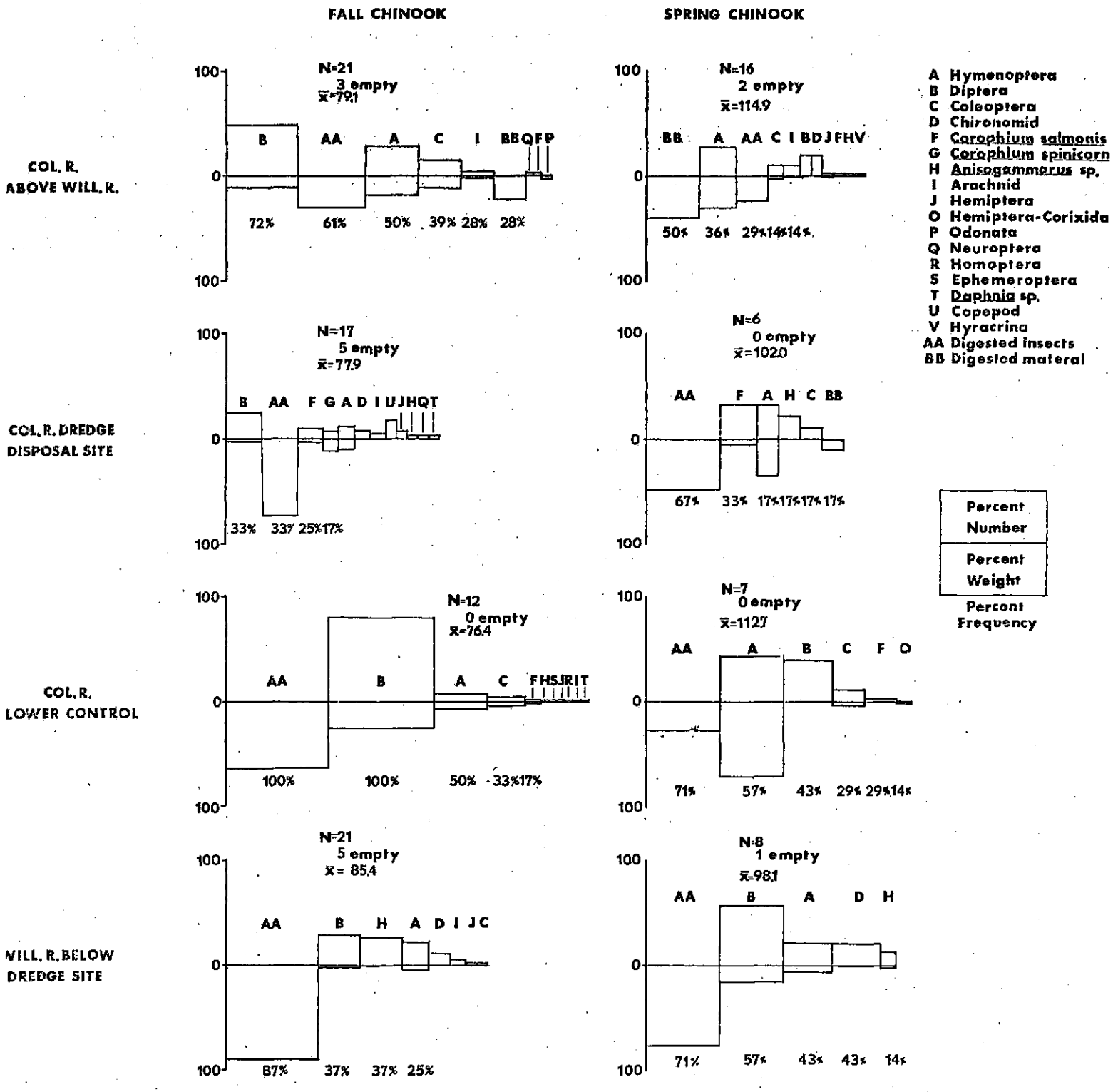


Figure 4...The IRI of food items consumed by juvenile spring and fall chinook salmon captured with a purse seine in the Columbia and Willamette Rivers.

(Figure 5). The 42 sockeye salmon juveniles consumed eggs as well as insects (Figure 6). Steelhead preferred Coleoptera and Hymenoptera but also consumed other insects (Figure 7).

SUMMARY OF PELAGIC AND DEMERSAL FISH

Purse seine catches of pelagic fish consisted of 497 fish in 8 sets; an average of 62.4 fish per set. A greater number of pelagic fish (457) was found in the Columbia River at the proposed disposal area (Table 3A), 76.2 per set, in contrast to 20 per set found in the clamshell dredge site in the Willamette River. Pelagic catches at both sites were 99% juvenile salmonids. Based on numbers (salmonids) chinook salmon (43.9%), coho salmon (31.4%), sockeye salmon (14.7), and steelhead (9.3%) dominated the catches, whereas, based on overall weight the makeup was steelhead (32.2%), coho salmon (26.1%), and chinook salmon (14.5%). The greatest catch of salmonids was taken in the Columbia River above the Willamette River confluence. Movement of Columbia River water into the deeper Willamette River apparently occurs, and possibly some juvenile salmonids follow the flow and use Multnomah Channel as a migration route. This could account for our finding fewer salmonids at the proposed disposal site and downstream comparison site.

Few demersal fish were taken in the 24 drag tows; a total catch of 43 fish (Table 4A). White sturgeon, Pacific lamprey, *Entosphenus tridentatus*, and chinook salmon were the most frequently taken of the nine species encountered. The total weight of the 43 demersal fish was 6.948 kg or 64% of the total pelagic fish weight. White sturgeon accounted for 81.2% of the total weight of all demersal fish. Bottom fish occurring at the proposed sediment disposal site appear evenly distributed but are far less common than would be found in an estuarine habitat.

Marked salmonids represented 8.7% of all salmonids captured by purse seining. The recovery rate was 10.1% when sockeye salmon were not included. Juvenile

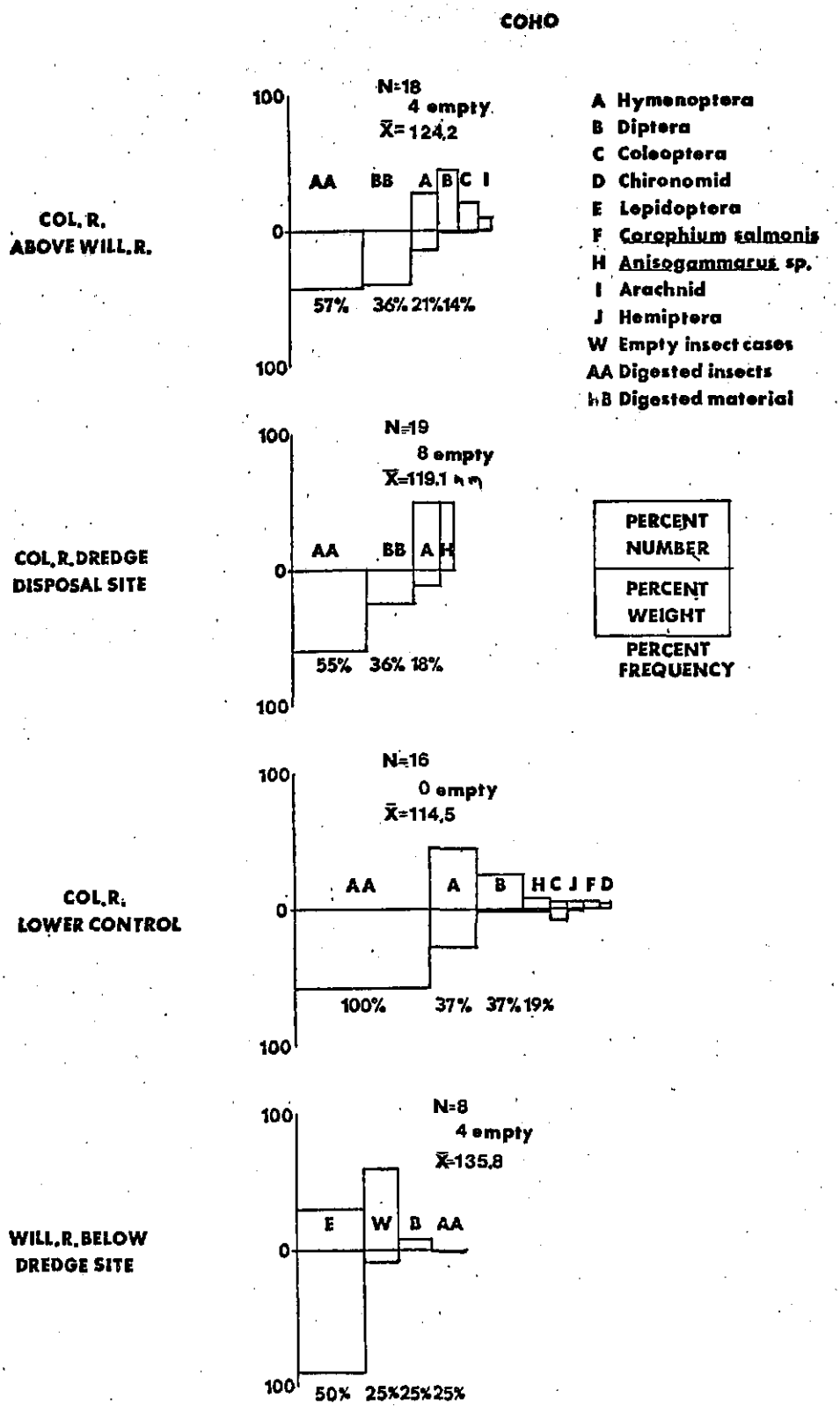


FIGURE 5.--The diet of 46 juvenile coho salmon as indicated by an IRI. The coho salmon were captured with a purse seine in the Columbia and Willamette River, June 1978.

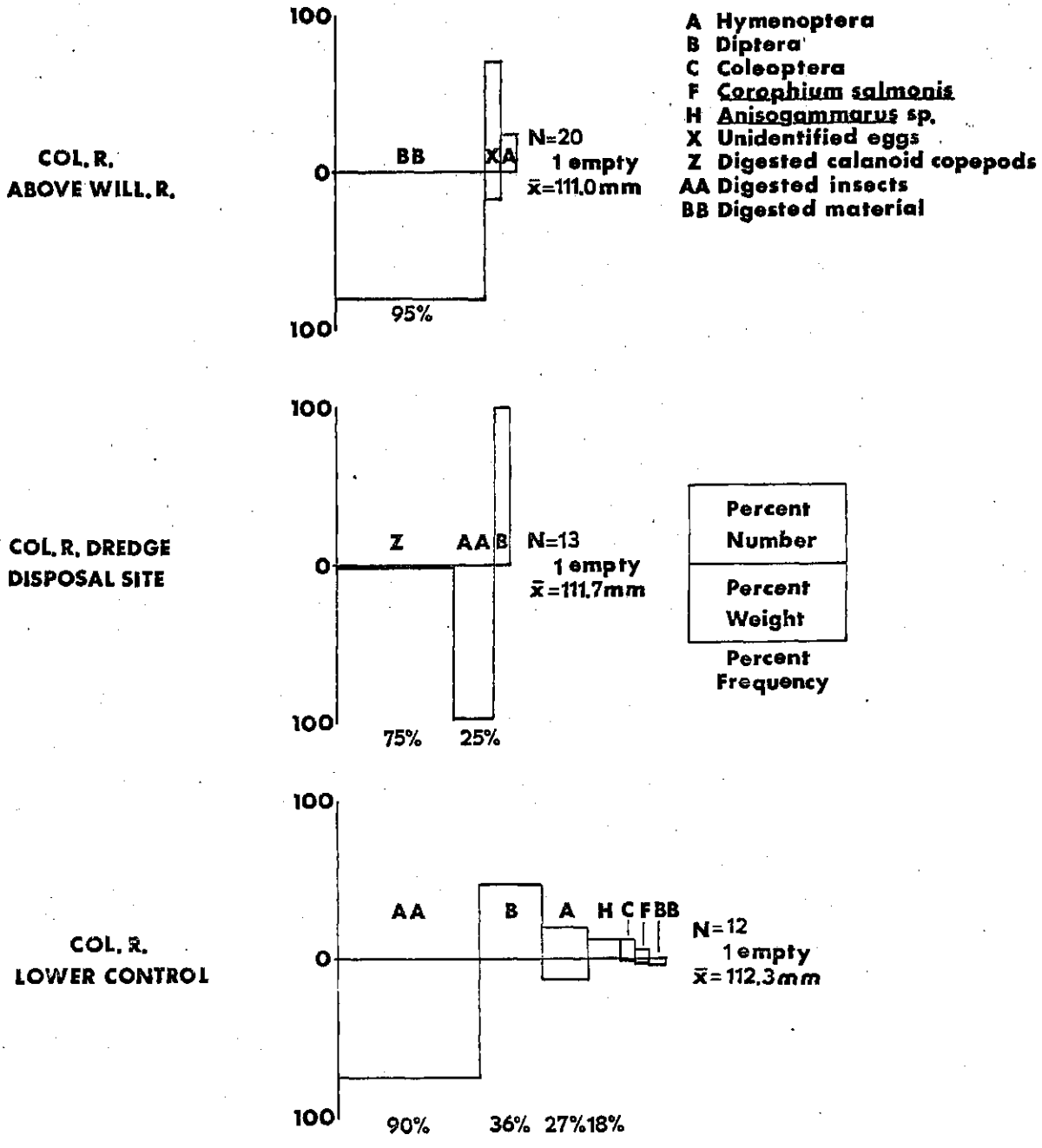


FIGURE 6.--The IRI of food items consumed by 42 juvenile sockeye salmon captured during purse seining in the Columbia and Willamette Rivers, June 1978.

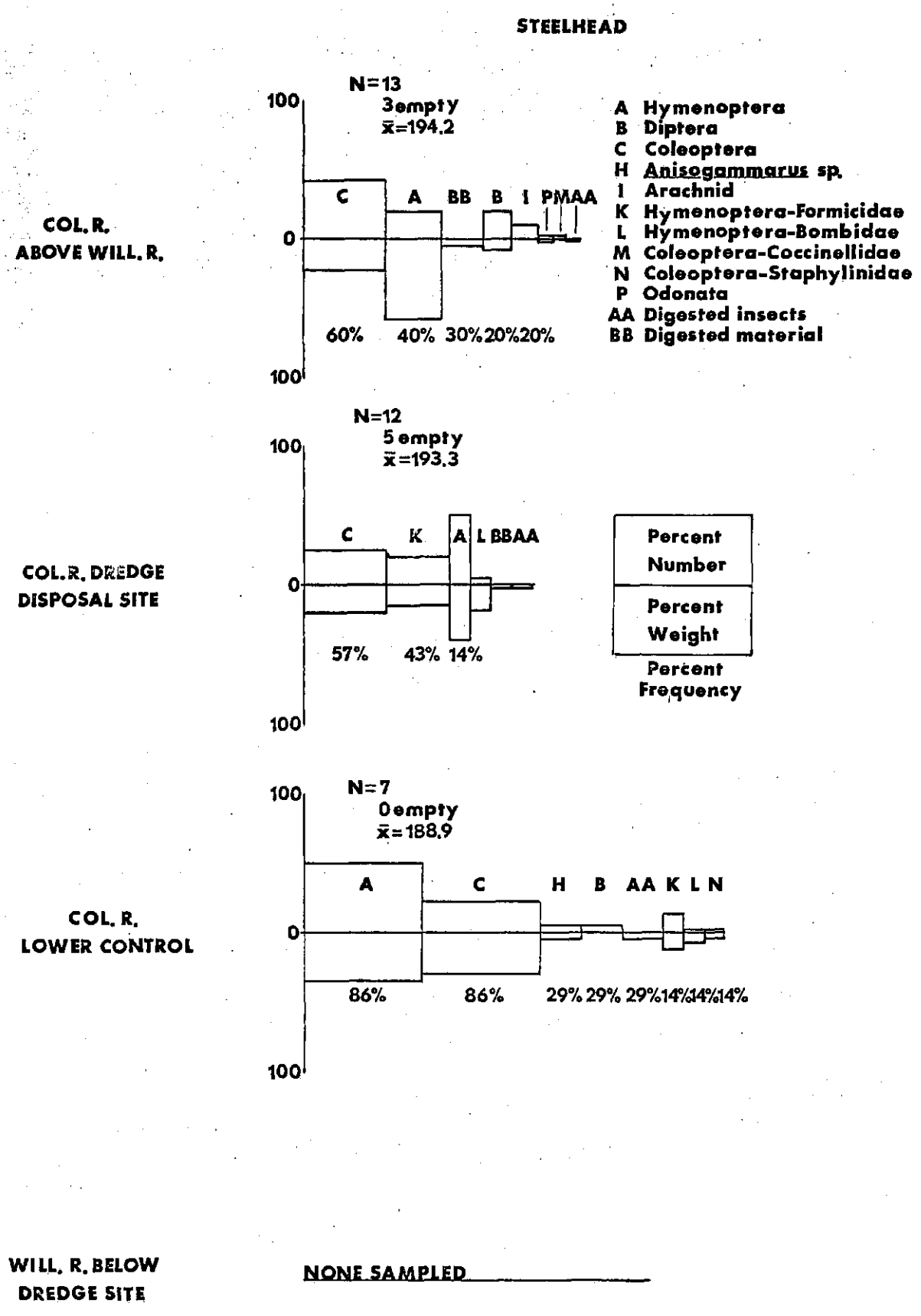


FIGURE 7.--The IRI for items consumed by 24 juvenile steelhead trout in the Columbia and Willamette River June 1978.

Table 4A...Species, numbers, and total weights (grams) of 24 five minute trawl catches in Columbia River during Portland Harbor Predredge and Disposal Study, Columbia River, May 1978.

Trawl Sites [1/]	1	2	3	2d	4	5	6	5D	7	8	9	8D	Total	Total
	Catch													
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	Wt.
May 16														
Pacific lamprey	--	--	--	1	--	--	--	--	--	2	--	2	5	21
White sturgeon	1	1	--	--	--	--	1	1	--	--	--	2	6	2913
Chum salmon	--	--	--	--	1	--	--	--	--	--	--	--	1	1
Spring chinook salmon	1	--	--	--	--	--	--	--	--	--	--	--	1	43
Fall chinook salmon	--	--	--	--	--	--	1	--	1	--	--	--	2	13
Finescale sucker	--	--	1	--	--	--	--	--	--	--	--	--	1	981
Western speckled dace	--	--	--	--	--	--	--	1	--	--	--	--	1	17
Coastrange sculpin	--	--	--	--	--	--	--	--	--	1	--	1	2	1
Total	2	1	1	1	1	0	2	2	1	3	0	5	19	3990
May 16-17														
Pacific lamprey	--	2	1	--	--	1	--	1	--	2	--	--	7	33
White sturgeon	--	--	--	1	2	--	--	--	--	--	--	2	5	2779
Chum salmon	--	--	--	--	--	--	--	--	--	1	--	--	1	1
Coho salmon	--	1	--	--	--	--	--	1	--	--	--	--	2	53
Sockeye salmon	--	1	--	--	--	--	--	--	--	--	--	--	1	9
Fall chinook salmon	1	2	--	--	--	--	--	--	--	--	--	--	3	24
Western speckled dace	--	--	--	--	4	--	--	--	--	--	--	--	4	51
Prickly sculpin	--	--	1	--	--	--	--	--	--	--	--	--	1	33
Total	1	6	2	1	6	1	0	2	0	3	0	2	24	2983

1/ See Figure 1.

salmon released in the Willamette River were captured in that system and not in the Columbia River. Marked salmon captured with the purse seine in the Columbia River were migrants from upper Columbia River hatcheries, tributaries, or release points.

Food utilization studies revealed a high incidence (81%) of feeding by pelagic fish. A variety of insects and amphipods with some cladocerans and copepods were consumed. Weights of food items were dominated by Hymenoptera and partially digested items that could not be identified.

The indicated food consumption of demersal fish was 56% and consisted of amphipods, chironomids, Diptera, and partially digested material.

Trawl tows and purse and beach seine sets were made to catalog fish abundance. Table 5 is a list of species in descending order of abundance for all fish captured by the three methods. Juvenile salmonids were the most frequently captured species; however, May, June, and July are the peak months of downstream migration. The species composition appears to be what one would expect during this time of the year.

There was no difference in trawl tow "counts" between the upper control, disposal, and lower control site. Purse seine catches showed significantly more salmonids at the upper control sites; whereas, the disposal area and lower control were approximately the same. Beach seine catches were comparable to those of the purse seine.

WATER QUALITY AT WILLAMETTE DREDGE SITE (RM 11.0)

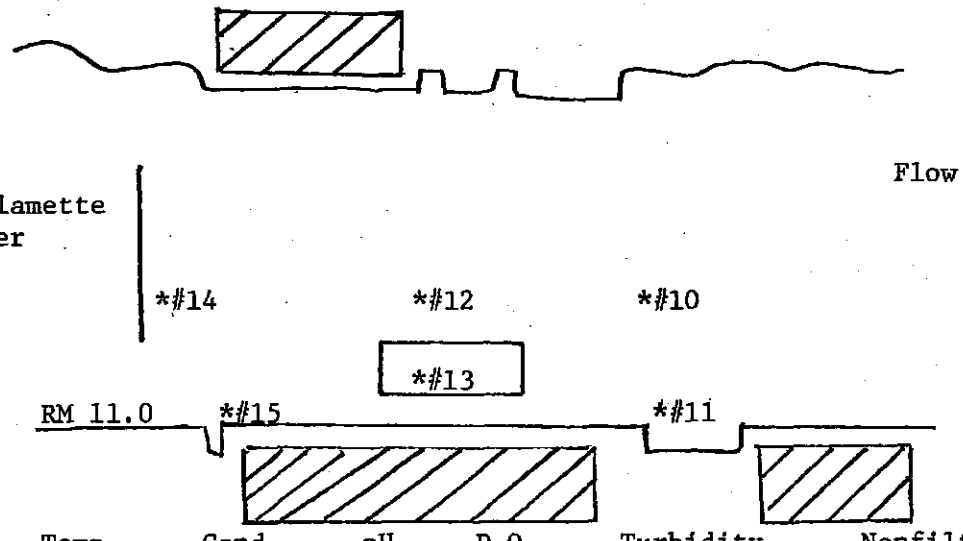
The gross water quality parameters measured at the Willamette clamshell dredge site are outlined in Figure 8.

The turbidity and dissolved oxygen data indicate that there was a minimal impact caused by the dredging operation. Increased turbidity occurred on or near the bottom while surface turbidity remained approximately the same as river background (the river background established by samples other than those taken "on site" at RM 11.0). Increased turbidity at the dredge site

Table 5...List of fish species and number captured by trawl tows and beach and purse seine sets between CRM 99 and 102 (see Figure 1) during preliminary "Portland Harbor Study". Species are listed in descending order of abundance.

Common name	Scientific name	Number captured
Fall chinook salmon	*Oncorhynchus tshawytscha*	4112
Coho salmon	*Oncorhynchus kisutch*	527
Spring chinook salmon	*Oncorhynchus tshawytscha*	81
Sockeye salmon	*Oncorhynchus nerka*	74
Steelhead	*Salmo gairdneri*	48
Peamouth	*Mylocheilus caurinus*	19
Pacific lamprey	*Entosphenus tridentatus*	13
White sturgeon	*Schipenser transmontanus*	11
Largescale sucker	*Catostomus macrocheilus*	10
Prickly sculpin	*Cyprinus carpio*	10
Speckled dace	*Cottus asper*	8
Black Crappie	*Rhinichthys osculus*	5
Carp	*Pomoxis nigromaculatus*	4
White crappie	*Pomoxis annularis*	3
Chum salmon	*Oncorhynchus keta*	2
Coastrange sculpin	*Cottus aleuticus*	2
Whitefish	*Prosopium williamsoni*	1
Finescale sucker	*Catostomus catostomus*	1
Blue	*Lepomis macrochirus*	1

Figure 8...Clamshell dredge site in Willamette River. Location of sampling stations are shown along with the summary results. Sampling was done on June 8, 1978.



Station	Depth (ft)	Temp. (°C)	Cond. (milmhos/cm)	pH	D.O. (mg/liters)	Turbidity (JTU)	Nonfilterable residue (mg/liters)
10	0	22.2	0.10	7.1	9.2	3.4	9.4
	36	20.6	0.10	6.6	7.8	5.4	17.6
11	0	21.6	0.10	7.1	9.0	4.5	10.9
	13	20.8	0.06	7.0	8.0	27.0	41.1
12	0	21.1	0.18	7.1	9.1	3.6	9.7
	35	21.0	0.10	6.9	7.4	46.0	66.6
13	0	21.8	0.04	7.5	9.2	4.2	10.5
	13	21.0	0.12	7.0	7.6	25.0	8.2
14	0	22.0	0.10	7.3	7.5	4.2	10.5
	34	20.6	0.11	7.0	7.5	13.0	22.3
15	0	21.8	0.16	7.3	9.1	4.6	11.0
	16	20.8	0.08	7.0	7.9	18.0	29.0

was approximately one-half that which can occur naturally in the Willamette River. The comparison is made between current data and results of an early study (McConnell 1979) which he found background turbidity of 88 JTU.

PURSE SEINING AT WILLAMETTE RIVER DREDGE SITE (RM 11.0).

A total of four purse seine sets was made near the Willamette dredge site (RM 11.0); two near the clam dredge operation and two approximately 2 miles upstream. White sturgeon and sculpin were captured (30-40 each set) at the upstream location; whereas, only a few fish were captured near the dredging operation.

WATER QUALITY ROSS ISLAND LAGOON

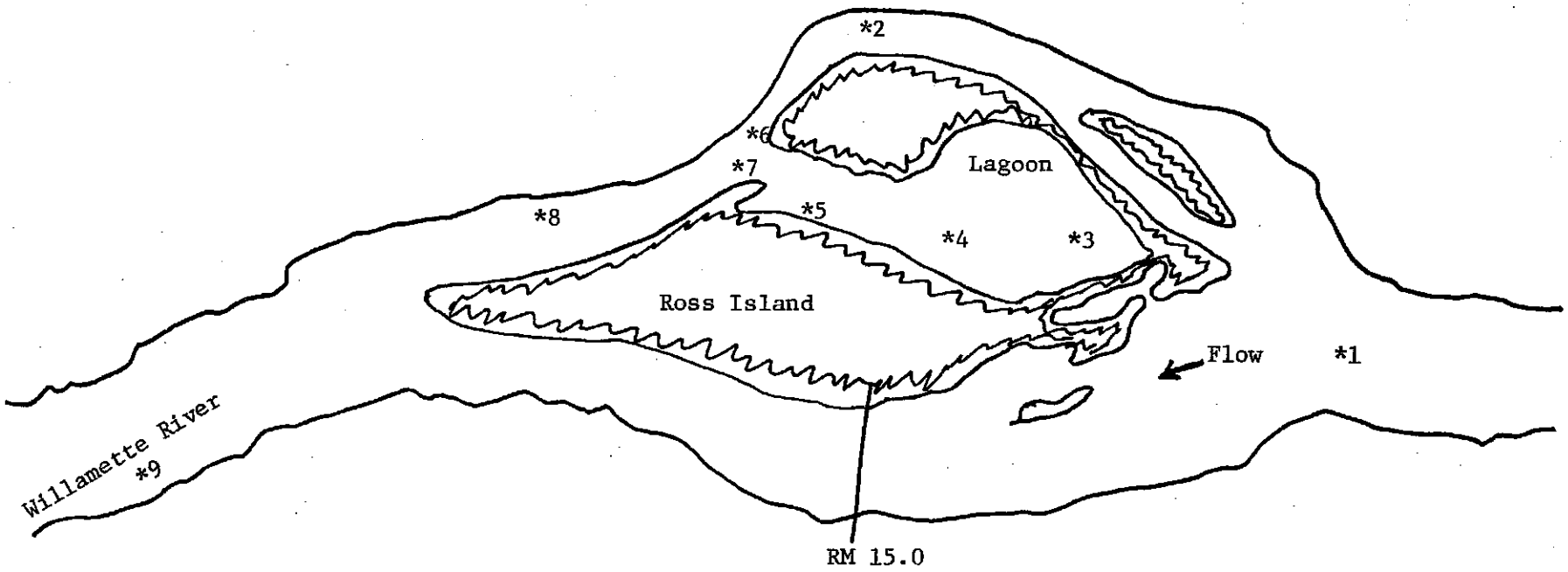
Figure 9 outlines the sampling stations and results of a water quality survey made on 8 June 1978 around and near Ross Island. During the sampling effort, commercial gravel removal was taking place within the lagoon. Upstream at Station 1, the river background turbidity ranged from 2.4 JTU at the surface to 4.0 JTU near the bottom; whereas, within the lagoon, a high of 130 JTU was recorded at 45 feet depth (bottom). The "sill" out of the lagoon (Stations 6 and 7) showed turbidities of 18 and 22 JTU which decreased downstream at Station 8 and 9 and ultimately reached river background a mile or so downstream.

Dissolved oxygen within the lagoon reached a low of 6.2 mg/liter--a level adequate to support fish life.

There was a wide variation in water temperature within the lagoon, e.g., at Station 4 it ranged from 21.0^{o}C at the surface to 13.8^{o}C on the bottom (45 feet).

The water quality within the lagoon was degraded somewhat by the commercial operation; however, it is questionable if dredged material disposal would degrade the lagoon to a greater of lesser degree.

Figure 9...Sampling station locations and summary results of water quality survey done at Ross Island on 8 June 1978.



Station	Depth (ft)	Temp. (°C)	Cond. (milmhos/cm)	pH	D.O. (mg/liters)	Turbidity (JTU)	Nonfilterable residue (mg/liters)
1	0	21.3	0.17	7.2	9.0	2.4	6.0
	30	21.1	0.13	7.2	8.7	4.0	10.2
2	0	22.2	0.22	7.2	9.1	2.8	8.4
	29	19.6	0.12	7.0	7.4	19.0	19.6
3	0	21.5	0.12	7.8	9.4	20.0	32.4
	45	14.1	0.10	7.0	6.2	130.0	179.4
4	0	21.0	0.12	7.4	9.6	18.0	29.0
	45	13.8	0.14	6.9	6.2	115.0	159.2
5	0	20.8	0.16	7.2	9.3	24.0	37.1
	10	18.7	0.14	6.8	7.2	21.5	33.7
6	0	22.4	0.10	7.5	9.2	11.0	19.6
	8	20.2	0.10	7.0	8.6	18.0	29.0
7	0	23.3	0.12	7.6	9.3	2.8	8.6
	25	19.5	0.06	7.3	9.4	22.0	34.4
8	0	22.6	0.10	7.2	9.4	3.3	9.3
	12	20.3	0.08	7.2	8.2	10.0	22.1
9	0	23.1	0.18	7.3	9.4	5.2	11.9
	39	21.3	0.10	7.1	9.0	6.2	13.2

SUMMARY CONCLUSIONS

1. Benthic abundance and diversity at the disposal site (and in and near the ship channel habitat) is much less than off-channel habitat areas of the lower Columbia River and its estuary.

2. Fish abundance compared favorably with that recorded in earlier studies in the Columbia River.

3. Stomach contents of fish captured during the study consisted mainly of: insects, Amphipoda, Bivalvia, and Oligochaeta.

4. Water quality at the disposal site was within natural limits expected during the sampling period.

5. Increased turbidity and decreased dissolved oxygen was evident near the dredging operation (in the Willamette River) and in the Ross Island lagoon. However, it is questionable if the degree of degradation exceeds that which occurs naturally in the Willamette River.

ACKNOWLEDGEMENTS

Analysis of finfish stomach contents was accomplished by Sandy J. Lipovsky. Nick Zorich, Roy Pettit, Edward Koller, Larry Davis, and Maurice Laird participated in purse seining efforts. Nick Zorich and Roy Pettit made up the trawl team. Carolyn Haller and Nancy Knox provided clerical assistance. Bill Muir with the guidance of Dick Ledgerwood extracted the tags, identified the marks, and determined the release sites.

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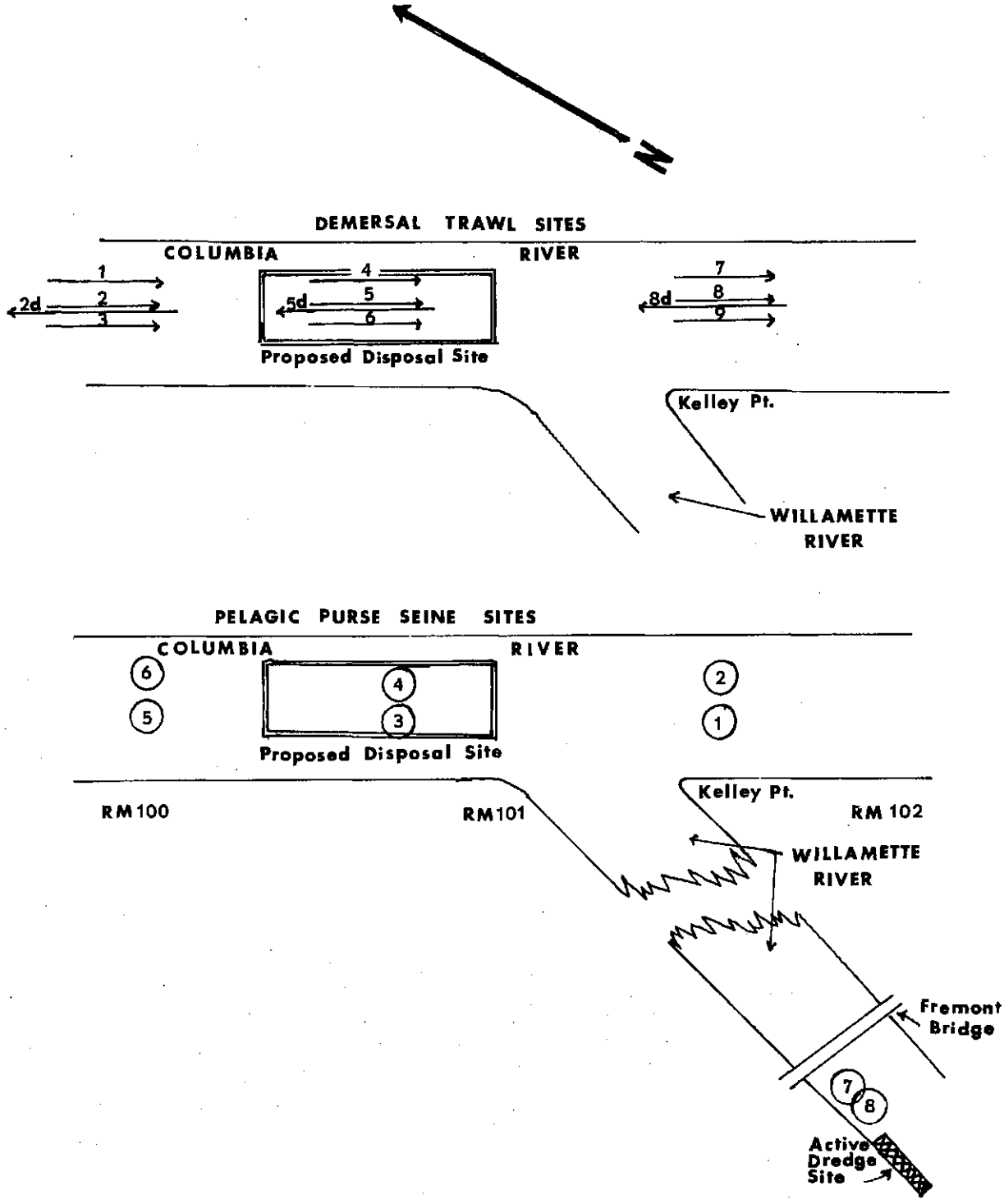
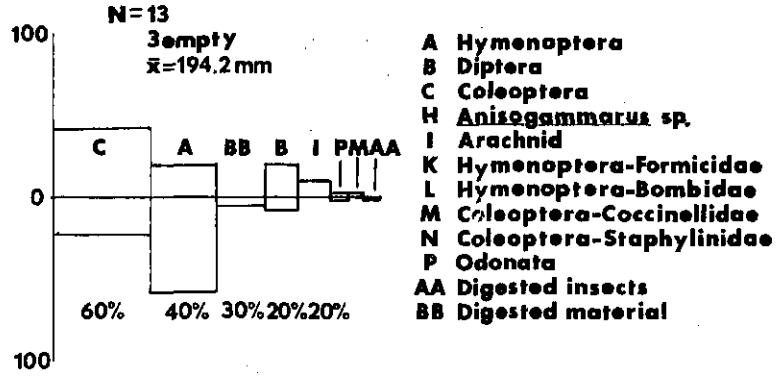

DEMERSAL TRAWL SITES
COLUMBIA
RIVER
1
2d
2
3
4
5d
5
6
7
8d
8
9
Proposed Disposal Site
Kelley Pt.
WILLAMETTE
RIVER
PELAGIC PURSE SEINE SITES
COLUMBIA
RIVER
6
5
4
3
2
1
Proposed Disposal Site
RM100
RM101
Kelley Pt.
RM 102
WILLAMETTE
RIVER
Fremont
Bridge
7
8
Active
Dredge
Site

STEELHEAD

COL. R.
ABOVE WILL. R.



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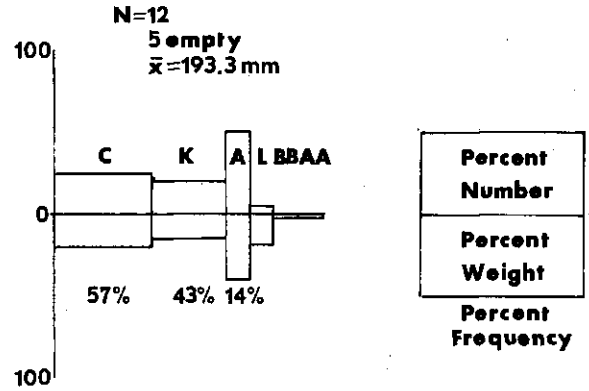
DISPOSAL SITE



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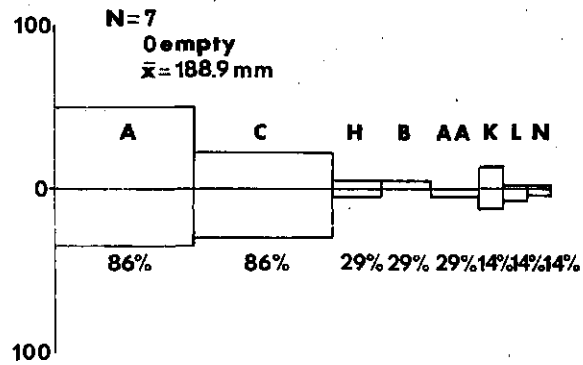
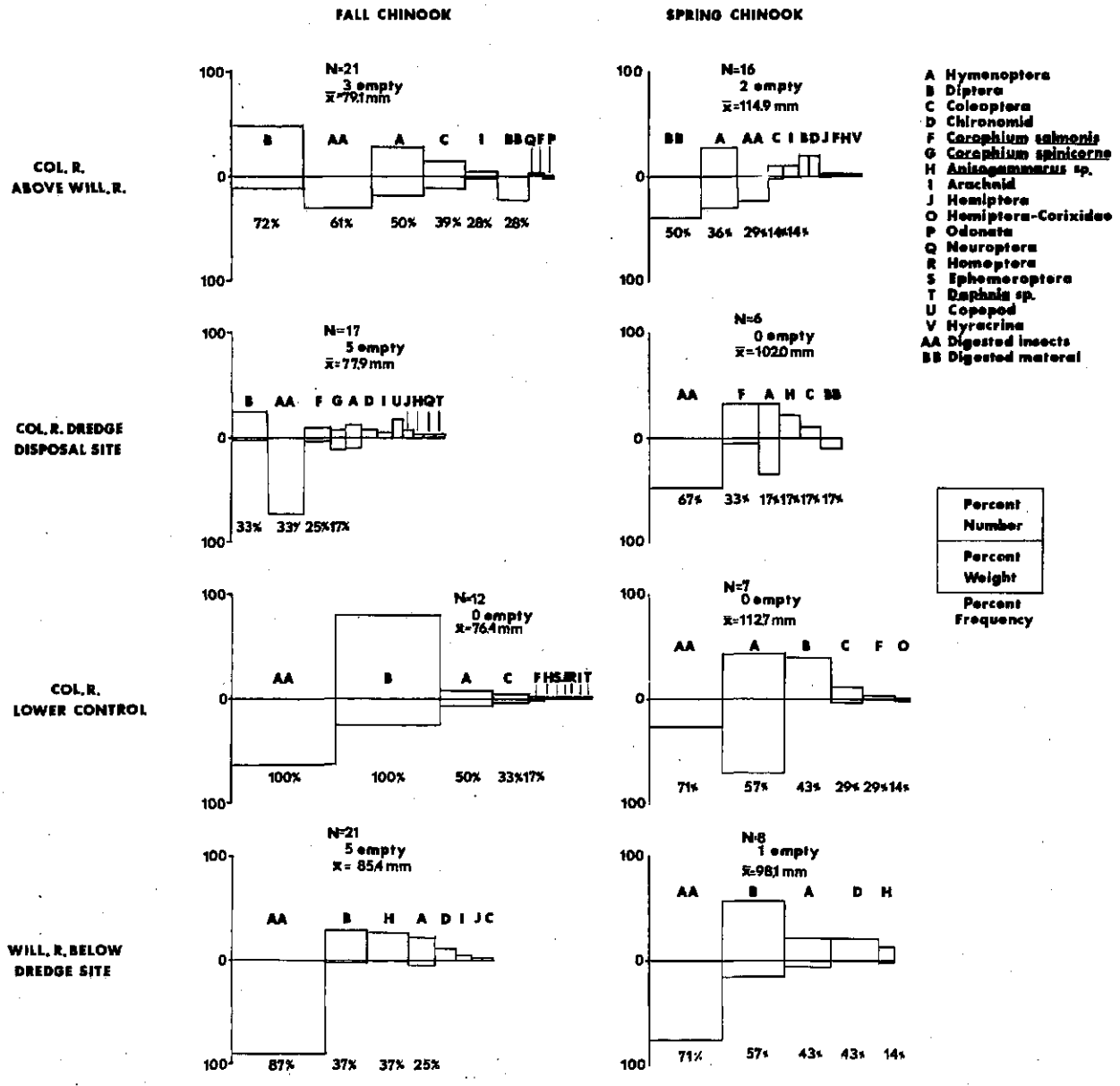
LOWER CONTROL



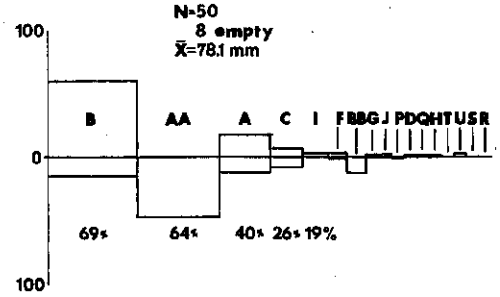
WILL. R. BELOW
DREDGE SITE

NONE SAMPLED


FALL CHINOOK
SPRING CHINOOK
COL. R. ABOVE WILL. R.
COL. R. DREDGE DISPOSAL SITE
COL. R. LOWER CONTROL
WILL. R. BELOW DREDGE SITE
N=21
3 empty
x̄=79.1mm
B AA A C I BB Q F P
72% 61% 50% 39% 28% 28%
N=16
2 empty
x̄=114.9 mm
BB A AA C I B D J F H V
50% 36% 29% 14% 14%
N=17
5 empty
x̄=77.9mm
B AA F G A D I U J H Q T
33% 33% 25% 17%
N=6
0 empty
x̄=102.0 mm
AA F A H C BB
67% 33% 17% 17% 17% 17%
N=12
0 empty
x̄=76.4mm
AA B A C F H S R I T
100% 100% 50% 33% 17%
N=7
0 empty
x̄=112.7mm
AA A B C F O
71% 57% 43% 29% 29% 14%
N=21
5 empty
x̄= 85.4 mm
AA B H A D I J C
87% 37% 37% 25%
N=8
1 empty
x̄=98.1 mm
AA B A D H
71% 57% 43% 43% 14%
A Hymenoptera
B Diptera
C Coleoptera
D Chironomid
F Corophium salmonis
G Corophium spinicorne
H Anisogammarus sp.
I Arachnid
J Hemiptera
O Hemiptera-Corixidae
P Odonata
Q Neuroptera
R Homoptera
S Ephemeroptera
T Daphnia sp.
U Copepod
V Hyracrina
AA Digested insects
BB Digested material
Percent Number
Percent Weight
Percent Frequency

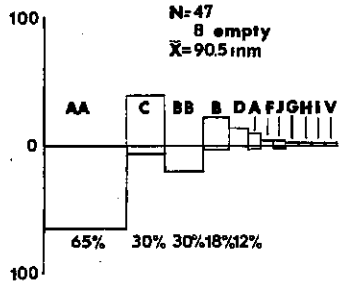
TOTAL NO.	TOTAL WT. (gm)
276	.9635

BEFORE
6-5-78



TOTAL NO.	TOTAL WT. (gm)
52	1.1167

AFTER
7-7-78



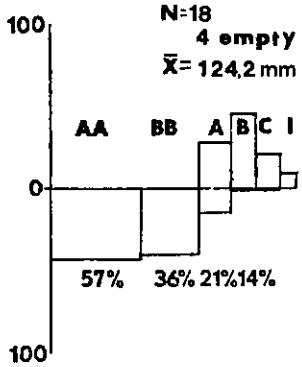
A Hymenoptera
B Diptera
C Coleoptera
D Chironomid
F Corophium salmonis
G Corophium spinicorne
H Anisogammarus sp.
I Arachnid
J Hemiptera
P Odonata
Q Neuroptera
R Homoptera
S Ephemeroptera
T Daphnia sp.
U Copepod
V Lepidoptera
AA Digested Insects
BB Digested Material

Percent Number
Percent Weight
Percent Frequency

IRI INDEX	DIPTERA	COLEOPTERA	HYMENOPTERA	CHIRONOMID	AMPHIPOD	OTHER	TOTAL
BEFORE	5064	403	1259	5	73	98	6902
AFTER	438	1293	105	166	38	50	2090

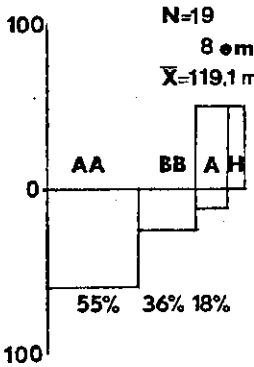
COHO

COL. R.
ABOVE WILL. R.



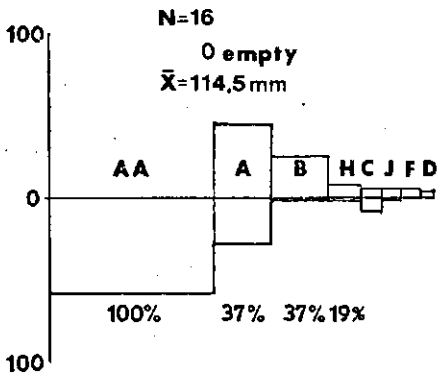
A Hymenoptera
B Diptera
C Coleoptera
D Chironomid
E Lepidoptera
F Corophium salmonis
H Anisogammarus sp.
I Arachnid
J Hemiptera
W Empty insect cases
AA Digested insects
BB Digested material

COL. R. DREDGE
DISPOSAL SITE

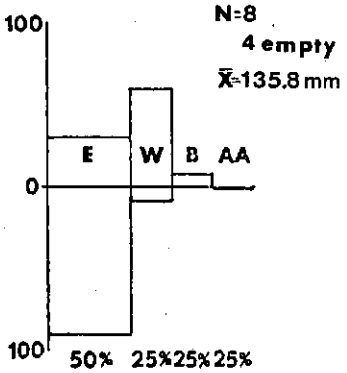


PERCENT NUMBER
PERCENT WEIGHT
PERCENT FREQUENCY

COL. R.
LOWER CONTROL

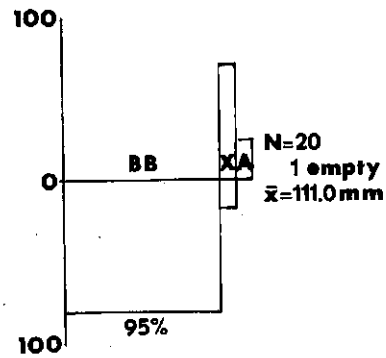


WILL. R. BELOW
DREDGE SITE



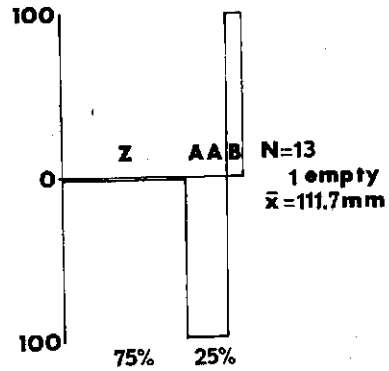
SOCKEYE

COL. R.
ABOVE WILL. R.



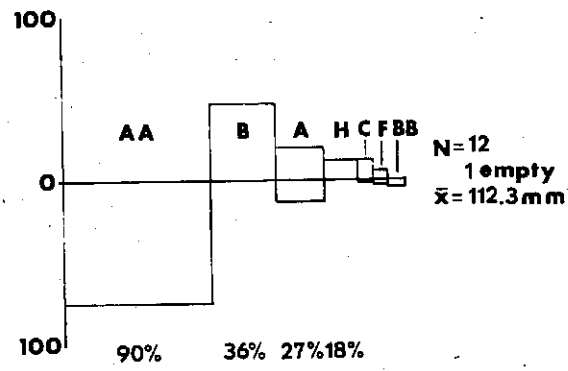
A Hymenoptera
B Diptera
C Coleoptera
F Corophium salmonis
H Anisogammarus sp.
X Unidentified eggs
Z Digested calanoid copepods
AA Digested insects
BB Digested material

COL. R. DREDGE
DISPOSAL SITE



Percent Number
Percent Weight
Percent Frequency

COL. R.
LOWER CONTROL



WILL. R. BELOW
DREDGE SITE

NONE SAMPLED